

U.S. ENVIRONMENTAL PROTECTION AGENCY
TECHNICAL ENFORCEMENT SUPPORT
AT
HAZARDOUS WASTE SITES

SF 105
YPLSF
RECEIVED
JUN 07 1988
WASTE MANAGEMENT BRANCH

TES IV
CONTRACT #68-01-7351
WORK ASSIGNMENT NO. 392

FINAL REPORT
RCRA FACILITY ASSESSMENT
YAKIMA AGRICULTURAL RESEARCH LABORATORY
YAKIMA, WASHINGTON

TETRA TECH, INC.
FOR
JACOBS ENGINEERING GROUP, INC.
PROJECT NUMBER: 05-B392-00
TC-3620-74-02

2 JUNE 1988

USEPA SF



1599770

CONTENTS

	<u>Page</u>
LIST OF FIGURES	iii
LIST OF TABLES	iv
1.0 INTRODUCTION	1
1.1 PRELIMINARY REVIEW	1
1.2 VISUAL SITE INSPECTION	2
1.3 AVAILABILITY OF DATA/DATA GAPS	2
1.4 PROJECT CONCLUSIONS	2
1.5 PROJECT RECOMMENDATIONS	3
2.0 DESCRIPTION OF FACILITY AND WASTES GENERATED	4
2.1 FACILITY DESCRIPTION AND HISTORY	4
2.2 WASTES GENERATED	7
2.3 ENVIRONMENTAL SETTING	9
3.0 LOCATION OF RCRA-REGULATED UNITS	16
4.0 RELEASE INFORMATION FOR RCRA-REGULATED UNITS	17
4.1 UNIT 1. SEPTIC TANK/DRAINFIELD SYSTEM	17
4.2 UNIT 2. SOLVENT STORAGE SHED	28
5.0 REFERENCES	31
APPENDICES	
APPENDIX A - HAZARDOUS WASTE MANIFESTS 1981, 1982, AND 1984 AND NOTIFICATION OF HAZARDOUS WASTE ACTIVITY 1980	
APPENDIX B - LOCAL WATER SUPPLY WELL RECORDS FOR YAKIMA (WA) AS PROVIDED BY WASHINGTON DEPARTMENT OF ECOLOGY	
APPENDIX C - RESULTS OF SEPTIC TANK/DRAIN FIELD SYSTEM SOIL AND WATER CHARACTERIZATION STUDY	

APPENDIX D - RESULTS OF PAH AND PESTICIDE ANALYSIS ON SOIL AND WATER
COLLECTED BY WASHINGTON DEPARTMENT OF ECOLOGY

APPENDIX E - YAKIMA AGRICULTURAL RESEARCH LABORATORY VISUAL SITE
INSPECTION PHOTO LOG

FIGURES

<u>Number</u>		<u>Page</u>
1	Location map of Yakima Agricultural Research Laboratory (YARL)	5
2	General zoning map of YARL vicinity	6
3	YARL site map	8
4	Location of known domestic downgradient wells	13
5	Proposed downgradient soil and groundwater sampling locations	27

TABLES

<u>Number</u>		<u>Page</u>
1	Water supply well records for Yakima, WA	14
2	Pesticides for 1986 experiments and plot maintenance	20
3	Residues analyses of DDT, TDE, and DDE in alfalfa, soil, and washings from alfalfa	21
4	Analytical results from 1983 soil sampling (ug/L)	24

1.0 INTRODUCTION

Tetra Tech, Inc. was contracted by the U.S. Environmental Protection Agency (U.S. EPA) to perform a Resource Conservation and Recovery Act (RCRA) Facility Assessment (RFA) for the Yakima Agricultural Research Laboratory (YARL) in Yakima, Washington. The objectives of an RFA are to identify and gather information on releases at RCRA-regulated facilities, to evaluate a facility's solid waste management units with respect to release of hazardous materials to all media, and to determine the need for further actions and interim measures at the facility. This report combines the findings of the preliminary review (PR) phase and the visual site inspection (VSI) phase of the RFA under the RCRA corrective action program. The PR and VSI were conducted following the U.S. EPA (1986) RCRA facility guidance manual. As a result of the PR and VSI, some data gaps have been identified.

1.1 PRELIMINARY REVIEW

The PR of YARL was conducted by examining and using information in U.S. EPA Region X and Washington Department of Ecology (Ecology) files. The following documents were reviewed:

- Closure/post-closure plans
- Wastewater facility soil, sludge, and groundwater sampling reports
- Correspondence
- Facility inspection reports.

The information gathered from these sources was used to identify and characterize potential releases from the facility and to focus the activities to be conducted in subsequent phases of the RFA.

1.2 VISUAL SITE INSPECTION

The VSI for the YARL facility was conducted on 9 September 1987. The inspectors arrived at the site and met with YARL director, Mr. Robert E. Dolphin. The opening meeting focused on the facility's waste management practices. Specifically, the types of waste the facility handles and the operation of the facility's septic tank were discussed in detail. Following the opening meeting, Mr. Dolphin showed the inspectors the site. Mr. Eric Halfhill, research entomologist at YARL, joined the group during the site inspection. Photographs of waste management units were taken. A brief closing meeting was held to discuss observations made during the site inspection.

1.3 AVAILABILITY OF DATA/DATA GAPS

Groundwater quality data are not available for the facility wells because quarterly sampling has not commenced. Well logs for the two domestic wells ((b)(6) and (b) wells) located less than 1 mi south of YARL are not available. Water quality has not been monitored in any of the surrounding wells, making it difficult to assess the extent of groundwater contamination.

Soil sampling data collected in 1983 were available from YARL and Ecology. Additional soil sampling has not been conducted. More recent soil analytical data would have allowed a more comprehensive evaluation of the nature and extent of soil contamination.

Information regarding names and specific quantities of chemicals disposed of directly to the septic system does not exist.

1.4 PROJECT CONCLUSIONS

It has not been determined whether the groundwater beneath the site is contaminated. A number of factors may reduce the potential for groundwater contamination. The organochlorine pesticides routed to the drainfield are

relatively immobiles because of their low water solubility and high attraction to organic and mineral colloids in the soil. The high evapotranspiration rate and the fine textured layer of soil beneath the drainfield may retard downward migration of contaminants. In most cases, organophosphate and carbamate pesticides decompose rapidly in the soil because of chemical and microbial activity.

The groundwater monitoring wells installed at YARL in 1988 have not been sampled to date (Comstock, N., personal communication, 9 May 1988). Nearby domestic wells have not been sampled for pesticides. The soil sampling plan outlined in the facility's closure plan has not been implemented to date.

The soil monitoring plan proposed by YARL will be implemented in June 1988. The plan was designed to determine the nature and extent of soil contamination beneath and adjacent to the septic tank drainfield. The plan includes provisions for collection and analysis of soil samples to define the vertical and lateral extent of soil contamination.

1.5 PROJECT RECOMMENDATIONS

Potential groundwater and soil contamination associated with the septic tank drainfield will be handled in the closure and post-closure process. The groundwater monitoring wells installed at YARL in April 1988 will be sampled and analyzed for pesticide constituents. Water table elevations will be recorded on a quarterly basis to identify groundwater flow direction and seasonal variations. If contaminants are detected in these wells, an extensive hydrogeologic assessment should be implemented. This assessment should involve installing additional downgradient wells, conducting permeability and shallow aquifer tests, and sampling surrounding shallow domestic wells.

2.0 DESCRIPTION OF FACILITY AND WASTES GENERATED

2.1 FACILITY DESCRIPTION AND HISTORY

YARL occupies approximately 9.75 ac of land located at 3706 West Nob Hill Boulevard in the City of Yakima, Washington (population 60,000) (Figure 1). The laboratory is affiliated with the U.S. Department of Agriculture (USDA), and develops insect control techniques for fruits and vegetables. Approximately 60 full- and part-time employees work at the facility. Agricultural chemical products are not manufactured on the site. Areas surrounding the site are zoned residential, local small business, and planned development (Figure 2). Three schools, two hospitals, and three shopping centers are located within 0.5 mi of the site. The Yakima Municipal Airport is approximately 1.5 mi south of the site.

Initially, the YARL site was an orchard. Pesticide research began in 1961, and until a few years ago, chemical control studies using pesticides were a major emphasis (approximately 60 percent) of the laboratory's program. A wide variety of pesticide wastes and solvents were discharged to a septic tank and drainfield disposal system at the facility from 1965 to 1985. Prior to 1965, wastes were disposed of directly on the ground (Betz, J., 8 July 1982, personal communication). Because the septic tank and drainfield system allowed pesticides to permeate the soil and because the area is characterized by highly permeable sands and gravels, there is concern that pesticides may be leaching into the shallow drinking water aquifer.

In the past several years, the research emphasis at YARL has changed. Pesticide research is now a minor component (approximately 10 percent) of the research program. Research on systems using natural and biological controls is now emphasized. As part of the research program, pesticide residues are extracted from soil and plant materials by using solvents, including hexane and benzene. Currently, most solvent waste is recycled and

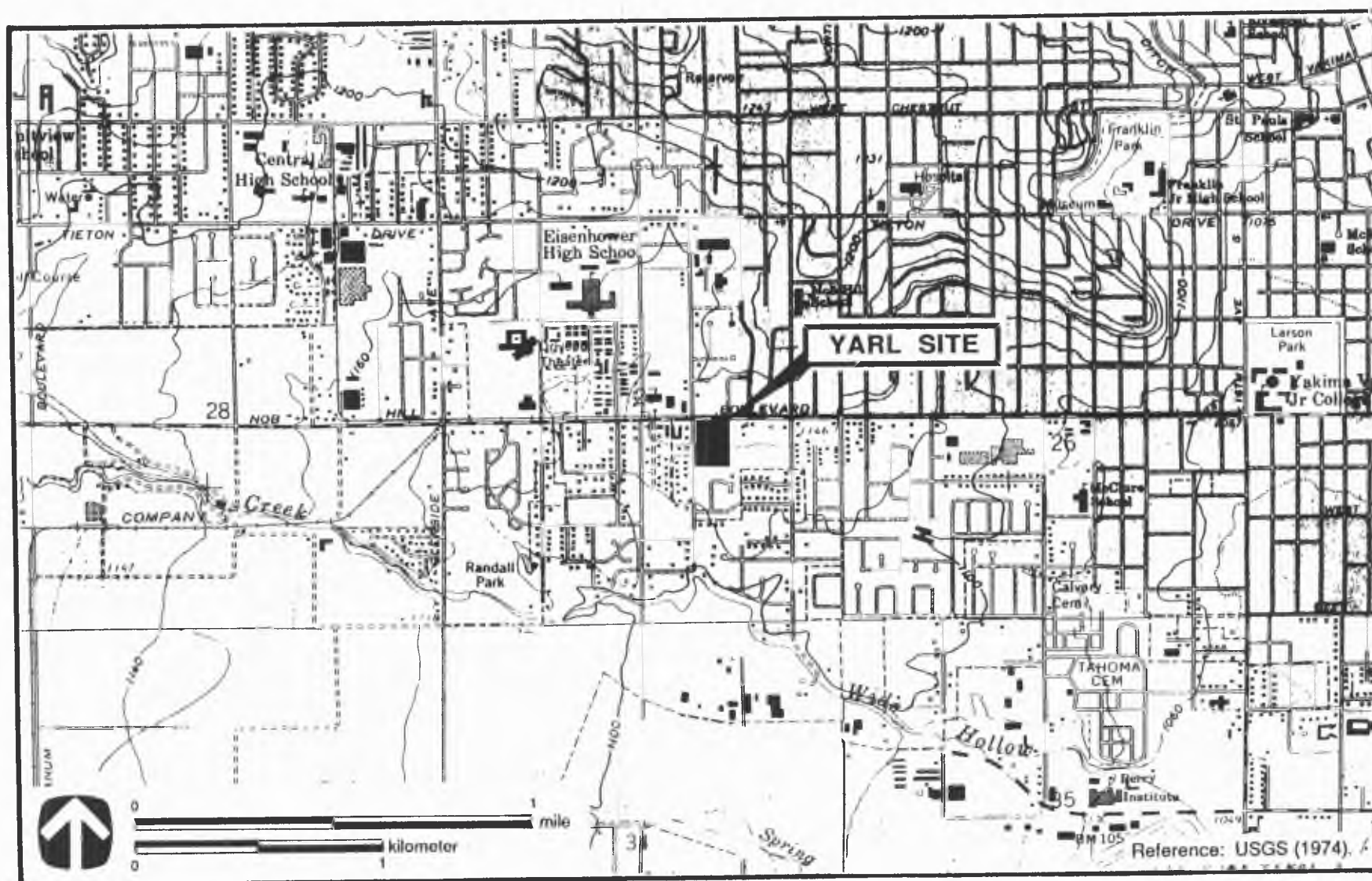


Figure 1. Location map of Yakima Agricultural Research Laboratory (YARL).

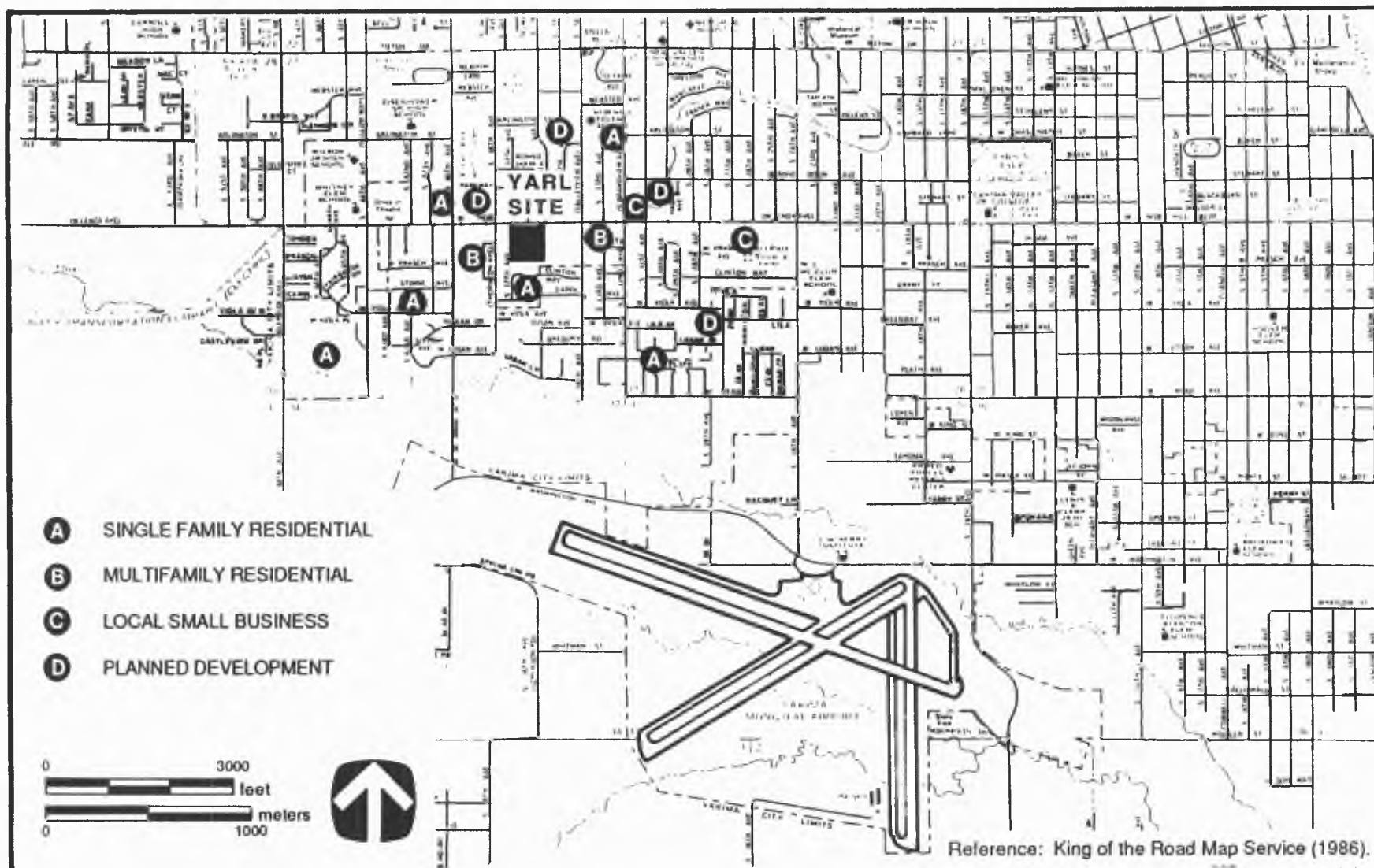


Figure 2. General zoning map of YARL vicinity.

the remaining solvent waste is transported offsite for disposal at a TSD facility. A map of the site is shown in Figure 3.

On 25 January 1985, YARL submitted a closure plan for the septic tank and drainfield system, including a monitoring component to sample and analyze soil and groundwater. Ecology reviewed and approved the plan. The groundwater monitoring system was installed in April 1988. Water quality analysis and water table elevation readings are expected to begin by the end of May 1988 (Comstock, N., 9 May 1988, personal communication). Soil sampling in the drainfield area is expected to begin in June. Core samples and drill cuttings were not analyzed during installation of the groundwater monitoring wells (Baumeister, R., 24 May 1988, personal communication).

2.2 WASTES GENERATED

Wastes generated at the YARL facility consist of a wide variety of pesticide mixtures, rinsates from the cleaning of sprayers and other equipment, and solvents. Until 1981, pesticide concentrate materials were stored onsite as part of active experimental pesticide inventories. The quantity of materials stored is not known. In more recent years, unwanted pesticide concentrate materials and solvent wastes have been shipped offsite to a licensed disposal facility. In 1981, 1982, and 1984, shipments of 1,725, 884, and 1,849 lb, respectively, were sent via a licensed chemical waste hauler to the Chem-Security Systems facility near Arlington, Oregon. Manifests for these shipments are provided in Appendices A-1 (1981), A-2 (1982), and A-3 (1984). Every few years, pesticide stocks in the pesticide storage building (see Photo 3, Appendix E) are inspected and overage, unwanted, or contaminated materials are transported to Arlington. YARL contracts a transporter to drum the pesticides prior to disposal at Arlington. The pesticide storage building is not considered a RCRA-regulated unit because it is used to store pesticide products prior to use. YARL scientists use only the amount of pesticides they need and return the remainder to storage. A sink connected to the drainfield was used to rinse pesticide residues from empty bottles and sprayers. Because all the pesticide in the bottles is used prior to rinsing, the sink is not considered

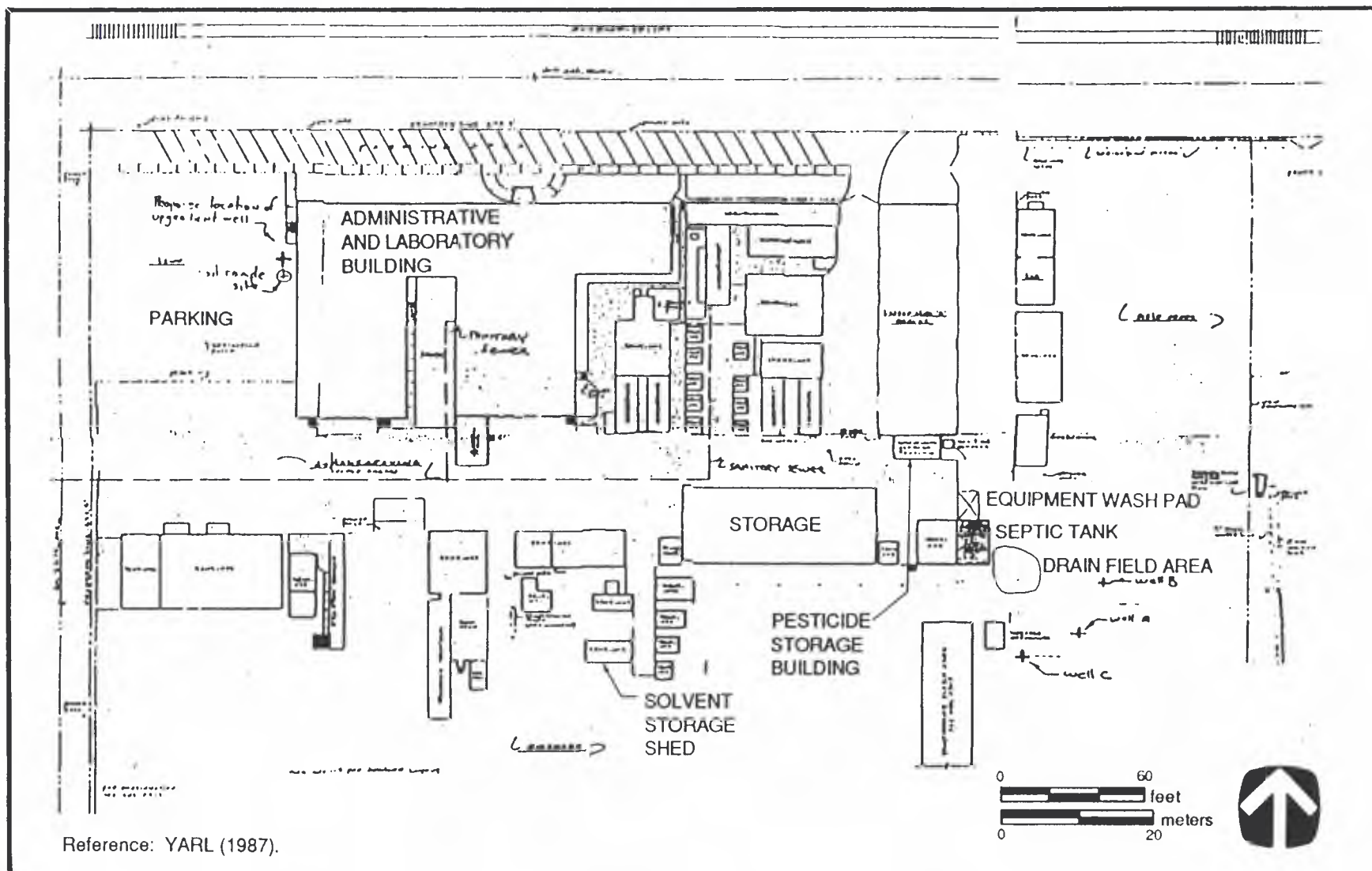


Figure 3. YARL site map.

a waste management unit (RCRA Hotline, 23 May 1988, personal communication).

Today, YARL research scientists request small quantities of pesticides, ordering only the quantity needed. They also seek arrangements to return excess product to the manufacturer. Some surplus pesticides are also given to farmers or used on research plots.

2.3 ENVIRONMENTAL SETTING

2.3.1 Climate

Yakima is located in northeastern Yakima County in south central Washington. The area lies in the rain shadow east of the Cascade Mountains and is characterized by a dry continental climate. The Yakima Valley is generally flat with average elevation above mean sea level of 1,064 ft.

Average annual precipitation in Yakima is approximately 8 in, with a mean annual lake evaporation of 42 in (USDA 1979). Three-quarters of the precipitation occurs between October and March, with December and January being the wettest months. July through September tend to be the driest months.

The mean annual temperature in Yakima is approximately 50° F (USDA 1979). Summers are sunny, warm, and dry. During the warmest summer months, afternoon temperatures in the valley range from the high 80s into the 90s and exceed 100° F at times. In winter, average maximum temperatures are in the 30s and 40s, while minimums range from the teens to the lower 20s.

Winds in Yakima County are predominantly from the west to north (USDA 1979). Strongest winds occur when major storms pass over the area, usually during the fall and winter months.

2.3.2 Geology

The geology of the YARL site consists of Columbia Plateau basalts overlain by alluvial sediments of the Ellensburg Formation. The basalt layer is 250 ft thick and has been folded into a series of large-scale folds. Alluvial gravel, sand, silt, and clay constitute the Ellensburg Formation. This layer is 1,300 ft thick with permeabilities ranging from 5×10^{-3} to 3×10^{-1} cm/sec. These sediments are in turn overlain by approximately 30 ft of recent stream alluvium of the Yakima River and its tributaries. YARL occupies gently sloping ground over a syncline between two hill-forming anticlines (Ahtanum Ridge and Yakima Ridge). The site is a slight topographic high, with adjacent land to the south gradually sloping about 3 percent toward the south [U.S. Geological Survey (USGS) 1974].

Soils at the site are derived from loess and volcanic ash. The 1937-1942 soil survey of the U.S. Soil Conservation Service (SCS 1985) characterizes the YARL site as follows: Ritzville silt loam, 1-8 percent slope, on uplands. The surface soil is pale-brown silt loam about 7 in thick, neutral to mildly alkaline, noncalcareous. The subsoil is pale-brown to light yellowish-brown silt loam or loam about 30 in thick, mildly alkaline, calcareous in the lower part. The soil is not salty or alkaline, has slight erosion hazard due to slow surface runoff, is easy to work, and has moderate inherent fertility. It has medium internal drainage, a moderate to high capacity to hold water, and an indigenous cover of sagebrush and grass. The soil is suited for supporting irrigated orchards, alfalfa production, and pasture.

2.3.3 Hydrogeology

The regional groundwater system in Yakima is generally made up of two aquifers: a shallow aquifer in the alluvial deposits of the Ellensburg Formation and the Yakima River, and a deeper aquifer located in interflow zones of the Columbia basalts. The local hydrogeology of the YARL site is not well known. Water yields in the alluvial deposits are relatively low but adequate for domestic needs (Betz, J., 8 July 1982, personal communication).

The water table is shallow (33 ft), mainly because of extensive irrigation in the area during the summer and influx from creeks draining the mountains (Baumeister, R., 24 May 1988, personal communication). Ecology measured groundwater elevations in the two residential wells ((b)(6) and (b) wells) south of the site at depths of 9.1 and 19.4 ft below the surface. Information specifying which well measured 9.1 ft and which well measured 19.4 ft was not available. Water level fluctuations in the alluvium layer average about 4 ft, due to variations in stream levels, irrigation return flows, precipitation, and evapotranspiration. There is an upward movement of groundwater into the alluvium from underlying aquifers because the shallow aquifer water table is lower than the piezometric surfaces of the lower aquifers (Bechtel Environmental, Inc. 1988). This indicates that confining layers exist to generate upward gradients in the lower aquifer.

The groundwater flow is believed to be toward the south-southeast, although this direction may vary as much as 45° at any given location. This variance may be due to localized subsurface flow to two buried sloughs in the area (i.e., beneath 34th and 38th Avenues). Subsurface water in the two buried sloughs flows towards and terminates at Wide Hollow Creek. A 1985 USGS topographic map shows YARL located 1,146 ft above sea level. The nearest point on Wide Hollow Creek is located 1,100 ft above sea level. It appears that groundwater beneath YARL is generally flowing toward Wide Hollow Creek. There is not enough information to determine if groundwater discharges to Wide Hollow Creek or if the creek discharges to the groundwater. The effect of seasonal influences on groundwater flow direction is unknown.

City Water supplies drinking water to approximately three-quarters of Yakima's residents. The water is pumped from the Naches River, located 2-3 mi north of the YARL site, at a rate of 20 million gal/day. Four backup wells can provide 10 million gal/day of water to the city in the event the main water distribution system is inadequate. Two of these wells are artesian wells, located 1.5 mi southeast of the facility at the Yakima airport and 4 mi northeast of the facility at Kiwanis Park. A "rainy" well

is located 2 mi northwest of the facility near the Naches River. This well collects water through natural infiltration. A deep well, located 4 mi northeast of the facility, provides less than 1 million gal/day (Young, M., 9 May 1988, personal communication).

The Nob Hill Water Association is a private organization that supplies water from deep (500-1,800 ft) wells to approximately one-quarter of Yakima's residents in the western part of the city. These wells are located 2.5-4.5 mi northwest of the facility, at 6111 Tieton Dr., Crest Dr., Bluehills Pl., 8500 Scenic Dr., and 68th and King St. (Shepard, P., 12 December 1987, personal communication).

Water well reports for wells within several miles of the YARL site are included in Appendix B. According to these reports, 12 wells are completed in the shallow aquifer and more than half of those shallow wells are located hydrologically downgradient of the YARL site, in the presumed direction of groundwater flow. At least three shallow domestic wells are less than 1 mi from the site (Figure 4). Water supply wells and their locations are listed in Table 1. However, water well reports were not available from Ecology for the (b)(6) and (b) wells (Bowhay, D., 5 May 1988, personal communication). Groundwater is also used for irrigation purposes in Yakima.

2.3.4 Surface Water

The closest surface water body to the YARL site is the Naches River and Cowiche Ditch, which is located about 500 ft northeast of the site. On a 1985 USGS map, a drainage ditch is located 0.4 mi northeast of the site. There are no other surface drainage ditches within 1 mi of the YARL site on the USGS map. However, Wide Hollow Creek, a perennial creek, is located approximately 0.5 mi south, topographically downgradient of the site, and flows east-southeast to the Yakima River. Wide Hollow Creek is used for bank fishing and domestic irrigation. The Yakima River is located approximately 4 mi east of the site, and the Naches River about 2.5 mi north of the site.

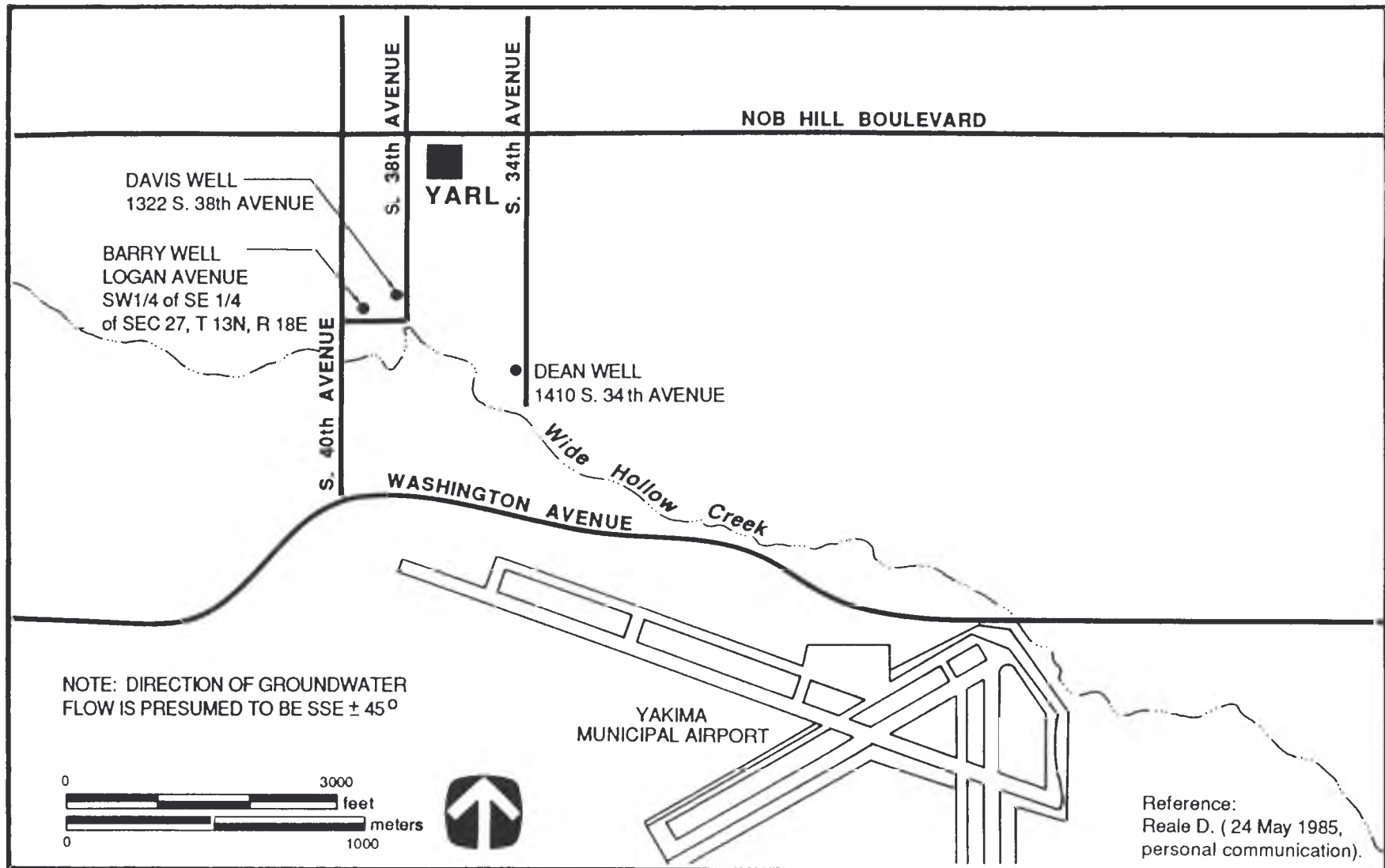


Figure 4. Location of known domestic downgradient wells.

TABLE 1. WATER SUPPLY WELL RECORDS FOR YAKIMA, WA

Owner	Location		Depth (ft)	Aquifer
	Street	Geographic		
(b)(6)	(b)(6)	NW SW Sec 34 T13N R16E	350	Deep
		SW SW Sec 34 T13N R18E	106	Deep
		NW SW Sec 34 T13N R18E	95	Deep
		NW SW Sec 34 T13N R18E	49	Shallow
		NW SW Sec 34 T13N R18E	60	Shallow
		NW SW Sec 34 T13N R18E	90	Deep
		NW SW Sec 34 T13N R18E	20	Shallow
		NE SW Sec 34 T13N R18E	21	Shallow
		NE SW Sec 34 T13N R18E	20	Shallow
		NE SW Sec 34 T13N R18E	20	Shallow
		NE SW Sec 34 T13N R18E	118	Deep
Congdon Orchards	--	NW SE Sec 34 T13N R18E	751	Deep
(b)(6)	(b)(6)	SW NE Sec 34 T13S R18E	92	Deep
		SE NW Sec 34 T13N R18E	75	Shallow
		SW NW Sec 34 T13N R18E	30	Shallow
Packaging Systems, Inc.	--	NW NE Sec 34 T13N R18E	117	Deep
Calvary Cemetery	1405 S. 24th Ave.	SW SE Sec 26 T13N R18E	132	Deep
Calvary Cemetery	1405 S. 24th Ave.	SW SE Sec 26 T13N R18E	190	Deep
(b)(6)	(b)(6)	SW SW Sec 26 T13N R18E	57	Shallow
		NE SW Sec 27 T13N R18E	65	Shallow
		NW SW Sec 27 T13N R18E	140	Deep
City of Yakima	129 N. 2nd St.	SW SW Sec 27 T13N R18E	332	Deep
(b)(6)	(b)(6)	SW SE Sec 27 T13N R18E	58	Shallow

High stages on the local rivers occur with the melting of the winter snowpack, generally during May and June. Peak flows and flash flooding have occurred along the smaller streams with local heavy rainfall in late fall, early winter, and sometimes spring.

3.0 LOCATION OF RCRA-REGULATED UNITS

The RCRA-regulated units at YARL include the septic tank/drainfield system (Unit 1) and the solvent storage shed (Unit 2). Locations of these units are shown in Figure 3. Descriptions are provided in the following section of this report.

4.0 RELEASE INFORMATION FOR RCRA-REGULATED UNITS

A discussion of each RCRA-regulated unit is provided in this section based on information obtained from the VSI and PR. Groundwater concerns for all RCRA-regulated units in Section 4 of this report will be addressed under the closure and post-closure process.

4.1 UNIT 1. SEPTIC TANK/DRAINFIELD SYSTEM

4.1.1 Description

The septic tank/drainfield system (see Figure 3) was initially designed as a sanitary sewer system. The system was installed in 1961, probably by laboratory personnel (YARL 1987), using the standard plumbing methods of the time. A restroom in a nearby shop and storage building was constructed concurrently with the septic system. The washbasin and toilet of the restroom are linked to the septic tank by drain pipes. Connections were added to modify the system for pesticide disposal. There are no records on file specifying construction of the system.

The septic tank/drainfield system consists of a 300-gal concrete tank connected to a 4-in diameter, 30-ft-long concrete drain tile, installed approximately 2 ft below the ground and covered with topsoil. Overflow effluent from the tank is discharged through the drain tile, which is surrounded by a bed of stream gravel. An inactive buried irrigation line also runs east and west just south of the drainfield tile. This line once provided water for field irrigation from the Naches and Cowiche Ditch. Because the irrigation line apparently leaked, it was plugged in 1985 and replaced with a PVC pipe sprinkler system (Halfhill, J., 8 January 1988, personal communication).

Pesticides in dilute form were first introduced into the septic tank/drainfield system in approximately 1965, when the pesticide storage

building was constructed. The sink installed in this building was connected to the septic tank. Rinse water containing pesticides washed from hand sprayers, glassware, and containers would flow to the septic tank from this sink. In approximately 1974, a 165-ft² concrete pad surrounded by a surface drain was constructed. The surface drain was connected to the septic tank with a 4-in diameter concrete pipe. Field sprayers were drained of excess spray mixtures at the drain. Sprayers, tractors, and other equipment and vehicles were cleaned with a water hose at this site. Surface water runoff from the concrete pad entered the outdoor drain via the 4-in pipeline. The concrete pad is considered part of the septic tank/drainfield system and is not classified as a separate unit (RCRA Hotline, 23 May 1988, personal communication).

The sink in the pesticide storage building was disconnected from the septic tank in June 1984, following a decision by Agricultural Research Service management personnel to close the septic tank/drainfield system. Wastewater and rinsate delivered through the sink drain were collected in portable containers during the 1984 growing season and disposed of by application to overgrown field plots. Workers were instructed not to introduce any more insecticides into the septic tank/drainfield system. The ground drain was sealed with concrete in June 1985 when it became known that equipment washed at the outside drain was contaminated with pesticides. The restroom and washbasin in the shop and storage building remain functional and connected to the septic tank. Although the restroom and washbasin are used infrequently, wastewater is apparently discharged through the drains to the drainfield.

Prior to disconnecting the sink in the pesticide storage building and sealing the ground drain, the facility discharged to the septic tank/drainfield system an estimated 250 gal/yr of various pesticide solutions (5,000 gal over a 20-yr period), containing approximately 100 lb of pesticides, and approximately 5,000 gal/yr of rinsate from the application equipment (YARL 1987).

4.1.2 Waste Characteristics

Research at the laboratory involves the use of registered and experimental pesticides provided by chemical companies. Ecology (1987) estimated that several hundred compounds were disposed of during the 20 yr that the septic tank/drainfield system was in operation. Complete records indicating names and quantities of chemicals disposed of through the septic system do not exist. YARL apparently used a great variety of pesticides in small quantities. Diluted pesticides known to have been introduced into the system with wastewater include but are not limited to Guthion, Sevin, Malathion, Parathion, Tetraethylpyrophosphate (TEPP), DDT, Temik, Methoxychlor, Kelthane, Lindane, Captan, Cyprez, and Benelate (Ecology 1987). Apparently heavy metals, including lead arsenate, and pesticide concentrates were never discharged into the septic tank/drainfield system. The diversity of pesticides used onsite is represented by Table 2, listing names and quantities of pesticides used during the 1986 growing season (Pankanin, J., 20 February 1987, personal communication).

DDT, a persistent chlorinated hydrocarbon, was used by the previous owner, when the site was a pear orchard. DDT was last used in 1967, when a small amount was applied on a plot to determine the depth of migration into the soil. DDT was never discharged to the drainfield. In 1968, USDA discovered that alfalfa grown on YARL land was contaminated with residues of DDT metabolites at levels higher than 100 ug/kg. Chemists at YARL found DDT metabolites at concentrations in excess of 10,000 ug/kg in the upper 12 in of soil from the alfalfa plots (Butler et al. 1970). Results of these DDT residue analyses are shown in Table 3. Recent sampling has shown small amounts of detectable residues of DDT-pp' in the soil (Halfhill 1983).

A brief discussion of the physical and chemical properties of the pesticides used at YARL is provided below.

Organochlorine pesticides have long residence times and low mobility in the soil and exhibit resistance to microbial and chemical degradation. These compounds may persist in the soil for more than 30 yr. The following pesticides are classified as organochlorine:

TABLE 2. PESTICIDES FOR 1986 EXPERIMENTS AND PLOT MAINTENANCE

Advantage (I) ^a	1-2 gal	Noxfire (I)	1 qt
Alar (Plant GR) ^b	1 lb	Omite CR (I)	3 lb
Ammo (I)	1 lb	Orthene (I)	1 lb
Bayleton 50W (F) ^c	4 lb	Orthene (I)	1 lb
Baysir 25W (I)	1 lb	PBU-26 PB-Nox (I)	1 qt
Bay bue 1452 (I)	1 lb	PBU-26 piperonyl butoxide (I)	1 pt
Baytex 4 (I)	1 gal	Parathion (I)	4 lb
Butamin P&O (I)	1 cup (4 oz)	Pentac (I)	1 lb
Bay FCR 1272 (I)	1 pt	Pirimor 50W (I)	1.5 lb
Captan 25 percent SP (F)	11 lb	Pounce (I)	1 qt
Casoron (H)	20 lb	Princep 4L (H) ^d	1 gal
Chlorban granules (I)	1 lb	Pydrin 2.4 EC (I)	3 pt
Cymbush (I)	1 qt	Pyrenone (I)	1 cup (4 oz)
Cyprex 65W (F)	3 lb	Round-up (H)	1.75 gal
Diazinon (I)	4 lb	SBP 1382 (I)	1 pt
Dibrom 8EC (I)	2 gal	Sectrol (I)	24 oz
Dimilin 25W (GR)	10 lb	Spur (I)	1 qt
Disyston (I)	1 gal	Supracide (I)	2 gal
Dursban (I)	3 lb	Supreme oil (I)	50 gal
Furadan 15G (I)	5 lb	Surflan (H)	1 pt
Insectatapes (I)	12 cartons	Tempo 2C	16 oz
MK-936 (I)	1 L	TH 6043 25W (GR)	8 oz
Monitor 4EC (I)	1 pt	TH 6044 25W (GR)	8 oz
Morestan (I)	2 lb	TH 6045 25W (GR)	8 oz
Nicotine sulphate	2 pt	Zolone (I)	1 gal
Nudrin (I)	1 qt		

^a (I) = Insecticide.

^b (F) = Fungicide.

^c (GR) = Granular insecticide.

^d (H) = Herbicide.

Reference: Pankanin, J., 20 February 1987, personal communication.

TABLE 3. RESIDUE ANALYSES OF DDT, TDE, AND DDE
IN ALFALFA, SOIL, AND WASHINGS FROM ALFALFA

Test Number	Parts per billion ^a				
	DDE	Op'-DDT ^b	TDE ^b	Pp'-DDT	Total
In Alfalfa					
September 1967					
Test 1	39.0	21.0		129.0	189.0
Test 2	25.0	20.0		106.0	151.0
Average	32.0	20.5		117.5	170.0
May 1968	9.0	13.0	ND	23.0	45.0
June 1968					
Test 1	21.0	30.0	ND	52.0	103.0
Test 2	21.0	33.0	ND	69.0	123.0
Test 3	22.0	30.0	ND	63.0	115.0
Average	21.3	31.0		61.3	113.6
Washing experiment	In Washed Alfalfa and Washes ^c				
Test 1: alfalfa washed with chloroform	17.0	30.0	ND	54.0	101.0
Test 2: chloroform wash	3.0	4.0	ND	13.0	20.0
	2.0	3.0	ND	10.0	15.0
Average	2.5	3.5		11.5	17.5
Test 3: alfalfa washed with water	17.0	36.0	ND	62.0	115.0
Test 4: water wash	ND	ND	ND	3.0	3.0
	ND	3.0	ND	4.0	7.0
Average	ND	1.5		3.5	5.0
In Soil (May 31, 1968)					
Test 1	2,540	890	ND	4,980	8,410
Test 2					
a.	1,900	1,310	ND	5,510	8,720
b.	2,160	710	ND	3,030	5,900
Average	2,030	1,010	ND	4,270	7,310
Test 3					
a.	2,540	1,790	ND	7,510	11,840
b.	1,850	1,370	ND	5,510	8,730
Average	2,195	1,580	ND	6,510	10,285
Average for all tests	2,198	1,214	ND	5,308	8,720

^aThe residues in alfalfa were corrected for the recovery obtained that year. The residues in soil were not corrected. ND = not detected.

^bThe column used did not separate op'-DDT and TDE sufficiently to measure them separately. The later columns did, and TDE was not detected.

^cOnly one sample of alfalfa from each washing was analyzed for residues.

Reference: Butler et al. (1970).

- DDT
- Lindane
- Methoxychlor
- Captan.

Organophosphate and carbamate pesticides have a short residence time and degrade rapidly. Organophosphates are not persistent, with residence times ranging from 2 wk to several months. Carbamates are slightly to moderately persistent with residence times ranging from 1 to 3 mo. Both organophosphates and carbamates are susceptible to chemical and microbial decomposition and are not transported in the groundwater in measurable quantities. The following pesticides are classified as organophosphates and carbamates:

- Guthion
- Malathion
- Methoxychlor
- Parathion
- TEPP.

The low mobility, low water solubility, and resistance to degradation of organochlorine compounds suggest that they are likely to be contained in the soil beneath the drainfield. Organochlorine compounds have a strong tendency to attach to soil organic and mineral colloids. In comparison, organophosphate and carbamate compounds are dispersed rapidly from the soil due to the susceptibility of these compounds to chemical and microbial decomposition. These compounds are not likely to be detected in the soil at the YARL facility.

4.1.3 Migration Pathways, Evidences of Release, and Exposure Potential

Groundwater is a pathway of concern for contaminant migration. Contaminants released to the subsurface drainfield system may have infiltrated permeable sediments to shallow groundwater. There is potentially a preferred migration route for groundwater (i.e., the north-south sloughs buried under 34th and 38th Avenues). The high potential for evapotranspiration and fine textured layer of soil beneath the drainfield will retard downward groundwater migration.

One water sample was collected from the septic tank during a March 1983 study by the USDA. A control sample was collected along with the water sample. Samples were analyzed for several organophosphate and chlorinated hydrocarbon pesticides by research staff at YARL. The water sample from the septic tank contained no detectable residues (<0.05 mg/kg) of any of the pesticides analyzed (Halfhill 1983). Results of these analyses are presented in Appendix C.

During the USDA 1983 study, Ecology also collected one water sample from the septic tank and sent it to the U.S. EPA Region X laboratory for analysis. Concentrations of Aldrin, Dieldrin, DDT, Endosulfan, and Endrin found in the septic tank exceeded water quality criteria for drinking water consumption (see Table 4 for comparison). Results of these analyses are presented in Appendix D.

Surface water is a potential pathway of concern for contaminant migration. Wide Hollow Creek is located approximately 0.5 mi south of YARL. It is the nearest surface water downgradient from the site in the presumed direction of groundwater flow. Contaminated groundwater flowing toward the south-southeast may release contaminants to Wide Hollow Creek. Wide Hollow Creek flows east-southeast to eventually join the Yakima River. Surface runoff is minimal because the soils are permeable and the gradient is relatively gentle (3 percent).

TABLE 4. ANALYTICAL RESULTS FROM 1983 SOIL SAMPLING (ug/L)

Pesticide	Water Quality Criteria for Protection of Human Health	Measured Value
Aldrin	0	12
Endrin	1	35
Dieldrin	0	11
DDT	0	1,020
Endosulfan	74	280

Reference: U.S. EPA (1987).

Soil is a pathway of concern for contaminant migration. Two soil samples were collected from areas near the septic tank/drainfield system (at depths of 2 ft and 5 ft) on 3 March 1983 by the USDA. Two control samples were also collected, for a total of four samples. The exact locations of these samples was not documented. The samples were analyzed for several organophosphate and chlorinated hydrocarbon pesticides by research staff at YARL. The drainfield soil sample from a 2-ft depth indicated low concentrations of pesticide residues. This soil sample contained organochlorine pesticide residues of 0.05 mg/kg Lindane and 0.10 mg/kg DDT-pp' (Halfhill 1983). The subsurface soil samples from a 5-ft depth near the drainfield contained no detectable residues (<0.05 mg/kg) of any of the pesticides analyzed (Halfhill 1983). Results of these analyses are presented in Appendix C.

During the USDA 1983 study, Ecology also collected three subsurface soil samples (at depths of 2 ft, 5 ft and 5.5 ft) from the drainfield area. The exact locations of these samples were not documented. These samples were sent to the U.S. EPA Region X laboratory for analysis. Analytical results indicated that the concentration of DDT was 3 mg/kg in one soil sample collected near the drainfield. Results of these analyses are presented in Appendix D.

Air is not a pathway of concern for contaminant migration because contaminants were introduced to the soil 2 ft below the ground surface and will not migrate upwards. Pesticides disposed of in this area are not likely to migrate to the air because of their low volatility. The potential for contaminant migration through the air is extremely low.

Subsurface gas is not a pathway of concern for contaminant migration because the contaminants were introduced in dilute form and not capable of developing subsurface gas in explosive or toxic concentrations.

The potential for human exposure to contaminants associated with the septic tank/drainfield is considered low for all pathways except groundwater. Several residences south of the YARL site obtain drinking water from domestic wells. Because some of these domestic wells are presumed to be

downgradient of the YARL site, there is potential for exposure to of contaminants. The Yakima County Environmental Health Department does not have a file on YARL. There is no record of bacterial contamination of shallow groundwater in the vicinity of YARL (Bohway, D., 5 May 1988, personal communication). A properly functioning septic tank has bacterial-organic mats which chemically absorb pesticide molecules and tend to inhibit rapid movement of pesticides from the drainfield.

Wide Hollow Creek is located approximately 0.5 mi south of the site in the presumed direction of groundwater flow. Because Wide Hollow Creek is used for bank fishing and domestic irrigation, contaminated groundwater discharged into this creek may also affect aquatic biota, irrigated crops, and humans who use these resources.

4.1.4 Conclusions and Recommendations

It is unknown whether groundwater beneath the site is contaminated. The facility's groundwater monitoring wells have not been sampled to date. Nearby domestic wells have not been sampled for pesticides (Anderson, K., 28 July 1987, personal communication). YARL's (1987) soil sampling plan has not been implemented to date. Proposed soil and groundwater sampling locations are shown in Figure 5. The upgradient monitoring well is not shown because its location has not been established.

YARL has not yet characterized the hydrogeology of the site. Groundwater concerns will be handled under the closure and post-closure process. YARL's closure plan outlines monthly groundwater monitoring for water quality, water table elevation, groundwater gradients and flow direction, seasonal fluctuations, and effects of irrigation. A surface and subsurface soil sampling to characterize the nature and extent of soil contamination is also proposed in the closure plan.

If the results from YARL's soil and groundwater investigation indicate contamination, an extensive hydrogeologic assessment should be implemented including installation of additional groundwater monitoring wells, sampling

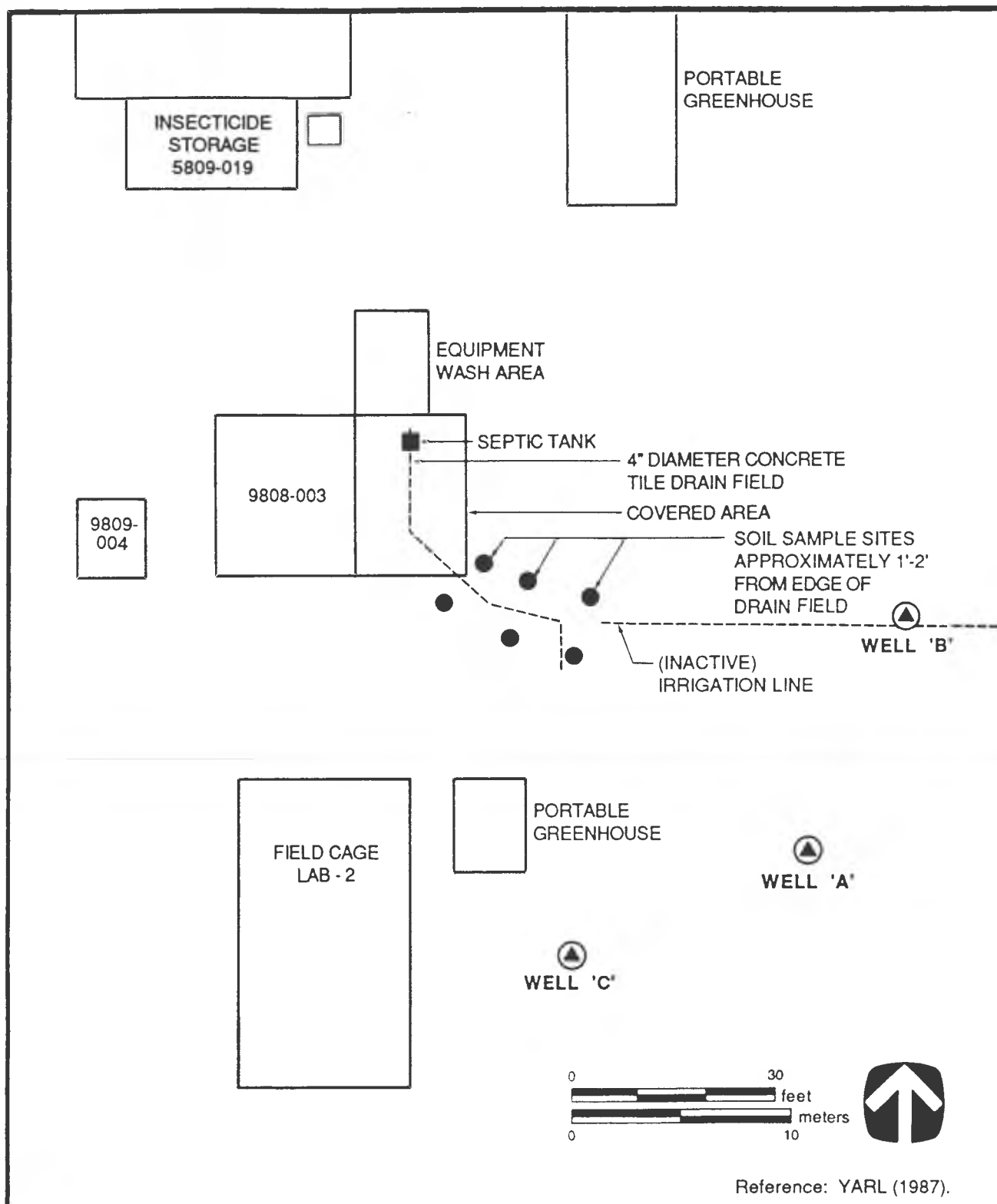


Figure 5. Proposed downgradient soil and groundwater sampling locations.

of downgradient domestic wells, and conduct permeability and shallow aquifer tests.

4.2 UNIT 2. SOLVENT STORAGE SHED

4.2.1 Description

The solvent storage shed, approximately 6 ft x 10 ft with a concrete foundation, is used for storage of both virgin and waste organic solvents (see Figure 3) (Photo 4 of Appendix E). Prior to "a couple of years ago," solvent wastes were sent to the county landfill (Dolphin, R., 9 September 1987, personal communication). Solvent waste is now shipped offsite to a licensed hazardous waste disposal facility (Chem-Security Systems in Arlington, Oregon). YARL generates about 25 gal/yr of solvent waste (Dolphin, R., 9 September 1987, personal communication). During the VSI, there were nine 5-gal drums of solvent waste in the storage shed (see Photo 4 of Appendix E). These wastes have accumulated since the last shipment was made to Chem-Security Systems, approximately 2 yr ago.

4.2.2 Wastes Characteristics

The chemists at YARL test for pesticide residues by using a number of solvents, including hexane and benzene. Wastes generated are actually a mixture of solvents, pesticides, and still bottoms. Solvents used in the chemistry laboratory are redistilled in a laboratory-scale distillation unit. Still bottoms from the distillation process and spent solvent and pesticide mixtures are collected in 5-gal drums. When the 5-gal drum is full, it is sealed and transferred to the solvent storage building. Known components of this solvent mixture, excluding the pesticide component, are described below.

- Benzene is an organic solvent. It is a U.S. EPA listed hazardous waste (F005), a priority pollutant, and known carcinogen.

- Hexane is not listed as a hazardous waste. However, it does have ignitable characteristics (D001).
- Still bottoms are generated from the recovery of spent organic solvents such as benzene. They are a U.S. EPA listed hazardous waste (F005).

4.2.3 Migration Pathways, Evidences of Releases, and Exposure Potential

The potential for contaminant migration from the solvent storage shed to groundwater is low. The shed has a concrete floor, and solvent wastes stored in the shed are sealed in 5-gal drums prior to transfer from the chemistry laboratory.

There is virtually no potential for direct release of wastes in the storage shed to nearby surface water. The surface water nearest to the solvent storage shed are the Naches River and Cowiche Ditch, located approximately 500 ft to the northeast.

There is a potential for the release of solvent waste to soil outside the storage shed if waste drums were spilled in transport to the storage shed. Because drums are sealed prior to transport, the potential for release to soil is low.

Air is not a pathway of concern for contaminant migration. Although many solvents are volatile, the potential for releases to the air is low because drums are sealed and stored in the solvent storage shed.

Subsurface gas is not a pathway of concern for contaminant migration. The potential for subsurface gas development is low because solvent waste are sealed within 5-gal drums and contained in a storage shed with a concrete floor.

The exposure potential to the environment from waste drums stored in the solvent storage shed is low, because of the shed construction design

and the drum sealing practices that are used. The shed has a concrete foundation and is enclosed by a berm.

4.2.4 Conclusions and Recommendations

No further action is required under the RFA/RCRA Facility Investigation process for the solvent storage shed. Mixed solvent, pesticide, and still bottom wastes stored in the solvent storage shed have a low potential for release to the environment. The exposure potential is low because of the drum sealing practices, the construction design of the shed, and the relatively small quantities of waste in storage. No spills were observed during the VSI.

5.0 REFERENCES

Anderson, K. 28 July 1987. Personal Communication (phone by Mr. Brian O'Neal, Tetra Tech, Inc.). Washington Department of Ecology, Environmental Quality Division, Yakima, WA.

Baumeister, R., 24 May 1988. Personal Communication (phone by Ms. Denise M. Jewett, Tetra Tech, Inc.). U.S. Department of Agriculture, Yakima, WA.

Bechtel Environmental, Inc. March 1988. Phase I remedial investigation report for a former pesticide formulation plant. Bechtel Environmental, Inc., Seattle, WA.

Betz, J. 8 July 1982. Personal Communication (internal memorandum to Mr. John Osborn, Ecology and Environment, Inc.) Ecology and Environment, Inc., Seattle, WA.

Bowhay, D. 5 May 1988. Personal Communication (phone by Ms. Denise M. Jewett, Tetra Tech, Inc.). Yakima Agricultural Research Laboratory, Yakima, WA.

Butler, L.I., B.J. Landis, and M.M. McDonough. 1970. Residues of DDT and metabolites in the soil and in alfalfa grown on former orchard land. Washington State University, College of Agriculture, Washington Agricultural Experiment Station, Pullman, WA. 5 pp.

Comstock, N. 9 May 1988. Personal Communication (phone by Ms. Denise M. Jewett, Tetra Tech, Inc.). Yakima Agricultural Research Laboratory, Yakima, WA.

Dolphin, R. 9 September 1987. Personal Communication (meeting with Ms. Susan C. Walker, Tetra Tech, Inc.). Director, Yakima Agricultural Research Laboratory, Yakima, WA.

Halfhill, J.E. 1983. Report of residue analysis, Yakima Agricultural Research Laboratory. Yakima Agricultural Research Laboratory, Yakima, WA. 30 pp.

Halfhill, J.E. 9 September 1987. Personal Communication (meeting with Ms. Susan C. Walker, Tetra Tech, Inc.). Yakima Agricultural Research Laboratory, Yakima, WA.

Halfhill, J.E. 8 January 1988. Personal Communication (phone by Ms. Susan C. Walker, Tetra Tech, Inc.). Yakima Agricultural Research Laboratory, Yakima, WA.

Huntamer, D. 19 April 1983. Personal Communication (letter to Merley McCall, Washington Department of Ecology). Washington Department of Ecology, Yakima, WA.

King of the Road Map Service. 1986. Map of Yakima, Selah, Union Gap. King of the Road Map Service, Inc., Seattle, WA.

Pankanin, J. 20 February 1987. Personal Communication (letter to Mr. C. Rice, Chief, RCRA Compliance Section, U.S. Environmental Protection Agency, Seattle, WA). U.S. EPA, Seattle, WA.

RCRA Hotline. 23 May 1988. Personal Communication (phone by Ms. Denise M. Jewett, Tetra Tech, Inc.). U.S. Environmental Protection Agency, Washington, DC.

Shepard, P. 12 December 1987. Personal Communication (phone by Ms. Susan C. Walker, Tetra Tech, Inc.). Nob Hill Water Association, Yakima, WA.

Sittig, M. 1985. Handbook of toxic and hazardous chemicals, and carcinogens. Second Edition. Noyes Publications, Park Ridge, NJ.

U.S. Department of Agriculture. 1979. Washington climate for Grant, Kittitas, Klickitat, and Yakima Counties. Washington State University, College of Agriculture, Pullman, WA.

U.S. Environmental Protection Agency. 1986. RCRA facility assessment guidance. U.S. EPA, Washington, DC.

U.S. Environmental Protection Agency. 1987. RCRA Facility Investigation (RFI) guidance Vol. I of IV. Development of an RFI work plan and general considerations for RCRA facility investigations. Draft. EPA 350/SW-87-001. U.S. EPA, Waste Management Division, Office of Solid Waste.

U.S. Geological Survey. 1974. Yakima West, WA: national topography map series, Scale 1:24,000. USGS, Reston, VA.

U.S. Soil Conservation Service. 1985. Soil survey of Yakima County area, Washington. U.S. Department of Agriculture, National Cooperative Soil Survey. 345 pp + 87 maps.

Washington Department of Ecology. 1987. Public notice and fact sheets regarding closure plan for Yakima Agricultural Research Laboratory, Yakima, WA. 222 chw and 224 chw. Washington Department of Ecology, Olympia, WA. 4 pp.

Wick, T. 12 December 1987. Personal Communication (phone by Ms. Susan C. Walker, Tetra Tech, Inc.). City Water, Yakima, WA.

Yakima Agricultural Research Laboratory. 1987. Plan amendment and revision of the closure plan for pesticide disposal drainfield at the USDA's Yakima Agricultural Research Laboratory, March 6, 1987. YARL, Yakima, WA. 20 pp. + attachments.

Yakima County Health Department. 5 May 1988. Personal Communication (telephone conversation with Ms. Denise Jewett, Tetra Tech, Inc.). Yakima County Environmental Health Department, Yakima, WA.

Young, M. 9 May 1988. Personal communication (phone by Ms. Denise Jewett, Tetra Tech, Inc.). City of Yakima Water Department, Yakima, WA.